



Melting Point Of Organic Compounds: A Comprehensive Guide

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Abstract

This comprehensive dataset presents the consolidated list comprising a melting point of 503 organic compounds encompassing active pharmaceutical ingredients, raw materials, and synthetic intermediates. Experimental melting points were compiled from literature and databases. A thorough literature search and database analysis yielded melting points of various organic compounds. This review serves as a valuable resource for medicinal chemists, Synthetic chemists, pharmaceutical scientists, Industrial personnel, and formulation experts seeking to optimize drug design, development, and manufacturing.

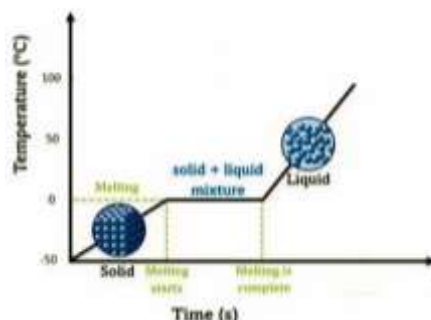
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Introduction:

The melting point, a fundamental physical property of substances, has been a cornerstone of chemistry and materials science for centuries. Defined as the temperature at which a solid transforms into a liquid at standard atmospheric pressure, Since the melting process requires overcoming the intermolecular forces that hold the solid structure together, the temperature at which a substance melts is directly influenced by the type and strength of these forces (Figure.1). The nature of these forces varies depending on the molecular structure of the substance, with stronger intermolecular attractions leading to higher melting points. The melting point plays a crucial role in understanding material's thermodynamic behavior, stability, phase transitions, and purity. ^[1]

Accurate determination of melting points is essential in various industries, including pharmaceuticals, materials science, and energy. With the advent of advanced analytical techniques and computational methods, researchers have made significant strides in understanding the complex phenomena governing melting points. Recent studies have explored the effects of pressure, solvent interactions, and nanoscale dimensions on melting behavior. In general, melting point determination is used in the lab in research and development as well as in quality control in various industry segments to identify and check the purity of different substances. ^[2,3]

The melting points of over 250,000 chemical compounds have been documented till date. These values have been gathered through experimental measurements and are stored in various scientific databases, such as the CRC Handbook of Chemistry and Physics, PubChem, and other specialized chemical repositories. The exact number continues to grow as new compounds are synthesized, discovered, or revisited in research. These databases serve as critical resources for scientists, providing a reference point



for identifying substances, predicting behaviors in different environments, and developing new materials across various fields.^[4]

Figure.1: Picture depicting compounds melting

At the melting point, there is a noticeable change in light transmission, which makes it an effective parameter for detecting when a substance transits from solid to liquid. Unlike many other physical properties, changes in light transmission are easy to measure, offering a reliable method for determining the melting point. Crystalline materials, when in powdered form, are typically opaque in their solid state but become transparent when melted. This distinct shift in optical properties can be quantified by measuring the percentage of light that passes through the substance, known as transmittance, as it is heated in a capillary tube. By correlating the light transmittance with the temperature inside the furnace, the melting point can be precisely determined.^[5]

The melting process can be divided into distinct stages, each marked by observable changes in the physical state of a substance. Here's a breakdown of the **stages of melting**:

1. **Moistening Point:** This is the initial phase of melting, where the solid begins to soften, but no liquid is yet visible. The substance may appear to moisten as it absorbs heat, though full melting has not started.
2. **Sintering Point:** At this stage, the solid particles become more compact as they begin to melt slightly, but not enough to turn into a full liquid. The material starts to lose its rigid structure and becomes denser.
3. **Collapse Point:** This marks the onset of melting, where the solid structure starts breaking down and the first signs of liquefaction appear. The temperature at this point is considered the beginning of the melting point range.
4. **Meniscus Point:** At this stage, a meniscus (a curved surface of liquid) forms as enough of the solid has melted. This is when the substance begins to adhere to the walls of the container.
5. **Clear Point:** The clear point is reached when the entire solid has melted, leaving only liquid in the container. This is the final stage, where the melting process is complete.^[6]

The pharmacopeia's requirements for melting point determinations can be summarized as follows:

1. **Capillaries:** Use capillaries with outer diameters between 1.3 mm and 1.8 mm and wall thicknesses between 0.1 mm and 0.2 mm for the melting point determination.
2. **Heating Rate:** The sample should be heated at a constant rate of 1 °C per minute.
3. **End of Melting (Clear Point):** Unless specified otherwise, the melting point is determined when no solid remains visible (referred to as the Clear Point or Point C), marking the end of melting.

4. Temperature Recording: The recorded melting point temperature reflects the temperature of the heating stand (either an oil bath or metal block) where the thermocouple is placed.

These guidelines ensure precise and standardized melting point determination across different Pharmacopeia's^[7]

Melting point analysis is a fast, simple, and cost-effective preliminary method, particularly when the sample is already largely pure and its identity is presumed. Moreover, it requires only a small amount of sample for testing.^[8] Table 1 gives an insight into the melting point of organic compounds used in Pharmaceutical industries, Synthetic chemistry laboratories and research laboratories.

Table 1. Melting Points of Various Organic Compounds.^[9,10,11,12]

Sl. No	Organic Compound	Melting Point in °C
1	1:3:4-Xylenol	26
2	1:4:2-Xylenol	74
3	2,4,5-Trinitro-alpha-naphthol	189
4	2,4,6-Trichloroaniline	77
5	2,4,7-Trinitro-alpha-naphthol	145
6	2,4-Diamino-alpha-naphthol	280
7	2,4-Diaminophenol	79
8	2,4-Dibromoaniline	80
9	2,4-Dichloro aniline	63
10	2,4-Dichlorophenol	35
11	2,4-Dinitro-alpha-naphthol	138
12	2,4-Dinitroaniline	176
13	2,4-Dinitrophenol	114
14	2,6-Dinitroaniline	138
15	2-Chloroquinoline	37
16	2-hydroxy-3-naphthoic acid	222
17	2-Nitro- <i>p</i> -toluidine	72
18	3,6-Dichlorophthalic acid	191
19	3-Nitro- <i>o</i> -toluidine	97
20	3-Nitro- <i>p</i> -toluidine	116
21	4-Aceto- <i>m</i> -xylidide	133
22	4-nitro <i>m</i> -chlorophenol	133
23	4-Nitro- <i>o</i> -toluidine	107
24	5-Amino- <i>o</i> -presol	176
25	5-Aminosalicylic acid	283
26	5-Flurouracil	282
27	5-Nitro- <i>o</i> -toluidine	130
28	6-Nitro- <i>o</i> -toluidine	92
29	Acenaphthene	85
30	Acetaldehyde ammonia	93
31	Acetamide	82
32	Acetanilide	115
33	Acethylphenylhydrazine	128
34	Acethylsalicylic acid	135
35	Acetic acid	16
36	Acetoacetanilide	85

37	Acetophenon	20
38	Acetophenoneoxime	59
39	Aceto- <i>p</i> -phenetidine	135
40	Acetoxime	59
41	Acetyl diphenylamine	101
42	Acetyl Phenylhydrazine	128
43	Aconitic acid	191
44	Acrylic acid	8
45	Adipic acid	151
46	Alizarin	289
47	Alloxan	170
48	Amygdalin	214
49	Anethole	21
50	Anisic acid	184
51	Anthracene	216
52	Anthranilic acid	144
53	Anthraquinone	273
54	Antipyrine	113
55	Apiole	30
56	Arbutine	165
57	Azelaic acid	106
58	Benzalacetone	41
59	Benzalaniline	54
60	Benzaldehyde cyanohydrin	21
61	Benzamide	128
62	Benzanilide	160
63	Benzene	5
64	Benzidine	127
65	Benzil	95
66	Benzilic acid	150
67	Benzoic acid	121
68	Benzoic anhydride	42
69	Benzoin	130
70	Benzophenone	48
71	Benzophenonoxime	143
72	Benzoquinone	115
73	Benzoyl phenylhydrazine	168
74	Benzoyl piperidine	47
75	Benzyl iodide	24
76	Benzylaniline	37
77	Benzylaniline	37
78	Benzylformanilide	48
79	Benzylmalonic acid	117
80	Benzylphthalimide	115
81	Benzylurea	149
82	Biuret	192
83	Bromoacetic acid	50
84	Bromoform	9
85	Bromohydroquinone	110
86	Bromoquinone	55

87	Caffeine	234
88	Camphorquinone	198
89	Capric acid	31
90	Caprylic acid	16
91	Carbanilide	238
92	Carbazole	238
93	Carbone tetra bromide	92
94	Carbostyryl	199
95	Cetechol	104
96	Cetyl alcohol	49
97	Chlorambucil	64
98	Chloroacetic acid	63
99	Chloroquinoline	112
100	Cinnamanilide	153
101	Cinnamic	133
102	Cinnamyl alcohol	33
103	Citraconic	80
104	Citric acid	100
105	Citric acid anhydrous	153
106	Coniferin	185
107	Coumaric acid	207
108	Creatine	315
109	Creatinine	315
110	Cyanoacetic acid	69
111	Cyclo Hexane	4
112	Cyclo Hexanol	20
113	<i>d</i> -Borneol	203
114	<i>d</i> -Camphor	175
115	<i>d</i> -Camphoric acid	187
116	<i>d</i> -Camphoric anhydride	221
117	<i>d</i> -Camphoroxime	118
118	Dextrose	146
119	<i>d</i> -galactose	166
120	<i>d</i> -galactose (hydrated)	119
121	<i>d</i> -Glucosamine	110
122	<i>d</i> -Glutamic acid	198
123	Diacetyl- <i>m</i> -phenylenediamine	191
124	Diacetyl- <i>o</i> -phenylenediamine	185
125	Diacetyl- <i>p</i> -phenylenediamine	304
126	Dianisidine	131
127	Dibenzyl	52
128	Dibenzylaniline	70
129	Dibenzylurea	167
130	Dicyandiamidine	105
131	Diethylcarbanilide	79
132	Digitalin	217
133	Dimethylcarbanilide	120
134	Dimethylglyoxime	245
135	Diphenyl	70
136	Diphenylamine	54

137	Diphenylamine	54
138	Diphenylguanidine	147
139	Diphenylguanidine	147
140	Diphenylhydrazine	34
141	Diphenylmethane	26
142	<i>Di-p</i> -tolylamine	79
143	Dixanthenylurea	265
144	<i>dl</i> -Alanine	295
145	<i>dl</i> -lactic acid	18
146	<i>dl</i> -Mandelic acid	118
147	<i>dl</i> -Phenylalanine	273
148	<i>dl</i> -Valine	298
149	<i>dl</i> - α -Amino- <i>n</i> -butyric acid	307
150	<i>d</i> -mannose	132
151	<i>d</i> -mannitol	166
152	<i>d</i> -tartaric acid	169
153	Elaidic acid	51
154	Ethyl acetanilide	54
155	Ethyl carbamate	49
156	Ethyl carbamate	49
157	Ethyl carbanilate	52
158	Ethyl mandelate	37
159	Ethyl <i>m</i> -hydroxybenzoate	72
160	Ethyl oxamate	114
161	Ethyl oxanilate	66
162	Ethyl <i>p</i> -hydroxy benzoate	116
163	Ethylene bromide	9
164	Ethylene diamine	8
165	Ethylene iodide	81
166	Ethylmalonic acid	111
167	Ethyl- <i>p</i> -aminobenzoate	89
168	Flufenamic acid	133
169	Fluorene	113
170	Formamide	3
171	Formanilide	47
172	Formyldiphenylamine	73
173	Formyldiphenylamine	73
174	Fumeric acid	286
175	Furoic acid	133
176	Galic acid	263
177	Ganiclovir	250
178	Glutaric acid	97
179	Glycerol	20
180	Glycerol tribromo hydrine	16
181	Glycine	232
182	Glycollic acid	79
183	Guaiacol	31
184	Helicin	175
185	Hexachlorobenzene	226
186	Hexachloroethane	187

187	Hexamethylenetetramine	280
188	Hippuric acid	187
189	Hydrazobenzine	131
190	Hydrobenzamide	102
191	Hydrobromide	203
192	Hydrocinammic acid	48
193	Hydroquinone	53
194	Hydroquinone diacetate	123
195	Ibuprofen	78
196	Indene	2
197	Inositol	225
198	Iodoacetic acid	83
199	Iodoform	119
200	<i>iso</i> -Amyl carbamate	64
201	<i>iso</i> -Butyl carbamate	55
202	<i>iso</i> -Butyramide	129
203	<i>iso</i> -Propyl carbamate	92
204	Isophthalic acid	300
205	<i>iso</i> -Quinoline	24
206	<i>iso</i> -Valerianilide	115
207	Itaconic acid	139
208	Lactose	203
209	<i>l</i> -Arabinose	159
210	<i>l</i> -Asparagine	226
211	<i>l</i> -Aspartic acid	270
212	Lauric acid	44
213	<i>l</i> -Camphane	51
214	Levulinic acid	33
215	Levulose	95
216	<i>l</i> -Leucine	294
217	<i>l</i> -malic acid	100
218	<i>l</i> -Menthol	42
219	<i>l</i> -Thyrosine	310
220	<i>l</i> -Xylose	144
221	<i>m</i> -Acetaminobenzaldehyde	84
222	Maleic acid	139
223	Maleic anhydride	56
224	Malonamide	170
225	Malonanilide	224
226	Malonic acid	133
227	Maltose	100
228	<i>m</i> -Aminobenzoic acid	174
229	<i>m</i> -Aminophenol	122
230	<i>m</i> -Bromoaniline	18
231	<i>m</i> -Bromobenzoic acid	155
232	<i>m</i> -Chlorobenzoic acid	158
233	<i>m</i> -Chlorophenol	28
234	<i>m</i> -Cresol	3
235	<i>m</i> -cresyl benzoate	54
236	<i>m</i> -Cresyl carbonate	111

237	Mesitol	68
238	Methyl anthranilate	15
239	Methyl anthranilate	25
240	Methyl carbamate	52
241	Methyl carbamate	52
242	Methyl citrate	79
243	Methyl <i>d</i> -Tartrate	48
244	Methyl mandelate	58
245	Methyl <i>m</i> -hydroxybenzoate	70
246	Methyl <i>p</i> -hydroxy benzoate	131
247	Methyl salicylic acid	101
248	Methylacetanilide	102
249	Methylgunidine	285
250	Methylmalonic scid	135
251	Methylsalicylic acid	101
252	<i>m</i> -hydroxybenzoic acid	200
253	<i>m</i> -Hydroxybenzoic acid	200
254	<i>m</i> -Iodotoluene	35
255	Mitomycin C	270
256	<i>m</i> -Nitophenol	97
257	<i>m</i> -nitroacetanilide	155
258	<i>m</i> -Nitroaniline	114
259	<i>m</i> -Nitrobenzaldehyde	58
260	<i>m</i> -nitrobenzamide	143
261	<i>m</i> -nitrobenzanilide	153
262	<i>m</i> -Nitrobenzyl alcohol	27
263	<i>m</i> -Phenylenediamine	63
264	<i>m</i> -Toluis acid	109
265	<i>m</i> -Toluylenediamine	99
266	Mucic acid	213
267	Myristic acid	53
268	Naphthalene	80
269	Naphthalene tetrachloride	182
270	Navuridine	161
271	<i>n</i> -Butyl carbamate	54
272	<i>n</i> -Butyl carbamate	54
273	<i>n</i> -Butyramide	115
274	<i>n</i> -Butyranilide	90
275	Nitotoluidine	116
276	Nitroguanidine	230
277	Nitrosoamine	12
278	<i>n</i> -Propyl carbamate	60
279	<i>n</i> -Propyl carbamate	60
280	<i>o</i> -Acetotoluidide	112
281	<i>o</i> -Aminophenol	174
282	<i>o</i> -Anisidine	5
283	<i>o</i> -Benzotoluidide	143
284	<i>o</i> -Bromoaniline	31
285	<i>o</i> -Bromobenzoic acid	150
286	<i>o</i> -Chlorobenzaldehyde	11

287	<i>o</i> -Chlorobenzoic acid	137
288	<i>o</i> -Cresol	31
289	Oleic acid	14
290	<i>o</i> -Methylaminophenol	96
291	<i>o</i> -Nitrophenol	44
292	<i>o</i> -Nitro aniline	71
293	<i>o</i> -nitroacetanilide	92
294	<i>o</i> -Nitrobenzaldehyde	44
295	<i>o</i> -nitrobenzamide	176
296	<i>o</i> -Nitrobenzyl alcohol	74
297	<i>o</i> -Phenylenediamine	102
298	Orcinol	58
299	<i>o</i> -Tolidine	129
300	<i>o</i> -Toluis acid	102
301	<i>o</i> -Tolylurea	191
302	Oxalic acid	101
303	Oxalic acid	189
304	Oxamide	418
305	Oxanilide	245
306	<i>p</i> -Acetotoluidide	147
307	<i>p</i> -Aminoacetanilide	162
308	<i>p</i> -Aminoacetanilide	162
309	<i>p</i> -Aminobenzaldehyde	79
310	<i>p</i> -Aminobenzoic acid	186
311	<i>p</i> -Aminodimehtylaniline	41
312	<i>p</i> -Aminodimethylaniline	41
313	<i>p</i> -Aminophenol	184
314	<i>p</i> -Anisidine	57
315	<i>p</i> -Benzotoluidide	158
316	<i>p</i> -Bromoaniline	63
317	<i>p</i> -Bromobenzoic acid	251
318	<i>p</i> -Bromophenol	63
319	<i>p</i> -Bromotoluene	28
320	<i>p</i> -Chlorobenzaldehyde	47
321	<i>p</i> -Chlorobenzoic acid	236
322	<i>p</i> -Chlorophenol	37
323	<i>p</i> -Cresol	35
324	<i>p</i> -cresyl benzoate	71
325	<i>p</i> -Cresyl carbonate	115
326	<i>p</i> -Dibromobenzene	89
327	<i>p</i> -Dichlorobenzene	53
328	<i>p</i> -Dimethylaminophenol	75
329	<i>p</i> -Dimthylaminobenzaldehyde	73
330	Pentaerythritol	253
331	Phenanthrene	100
332	Phenanthrenequinone	202
333	Phenol	42
334	Phenolphthalein	250
335	Phenoxyacetic acid	96
336	Phenyl acitic acid	70

337	Phenyl benzoate	68
338	Phenyl carbonate	78
339	Phenyl cinnamate	72
340	Phenyl phthalate	70
341	Phenyl propionate	20
342	Phenyl salicylate	42
343	Phenyl urea	147
344	Phenylacetamide	154
345	Phenylacetanilide	117
346	Phenylether	28
347	Phenylglycine	126
348	Phenylhydrazine	19
349	Phenylhydrazon	105
350	Phenyl-lactimide	290
351	Phenylmethylpyrazolone	127
352	Phenylpropionic acid	136
353	Phloroglucinol	218
354	Phorone	28
355	Phthalamide	219
356	Phthalanil	205
357	Phthalanil	205
358	Phthalimide	233
359	<i>p</i> -hydroxy benzaldehyde	116
360	<i>p</i> -hydroxybenzoic acid	213
361	<i>p</i> -Hydroxyphenylglycine	248
362	Pinacol	35
363	Pinacol hydrate	46
364	Pioglitazone	183
365	Piperazine	104
366	Piperazine (hydrate)	44
367	Piperic acid	216
368	Piperine	129
369	Piperonel	37
370	<i>p</i> -Methylaminophenol	85
371	<i>p</i> -Niroaniline	147
372	<i>p</i> -Nitophenol	114
373	<i>p</i> -Nitroacetanilide	210
374	<i>p</i> -Nitroaniline	147
375	<i>p</i> -Nitrobenzaldehyde	106
376	<i>p</i> -nitrobenzamide	201
377	<i>p</i> -Nitrobenzyl alcohol	93
378	<i>p</i> -Nitrosoamine	118
379	Polyoxymethylene	170
380	Populin	180
381	<i>p</i> -Phenetylurea	173
382	<i>p</i> -Phenylenediamine	140
383	Propanolol	92.9
384	Propiolic acid	6
385	Propionamide	79
386	Propionanilide	103

387	Propionyl α -naphthalamine	116
388	Protocatechuic acid	194
389	Pseudocumenol	71
390	Pthalic acid	195
391	<i>p</i> -Toluic acid	177
392	<i>p</i> -Toluidine	45
393	<i>p</i> -Tolunitrile	29
394	<i>p</i> -Tolylhydrazine	60
395	<i>p</i> -Tolylurea	181
396	<i>p</i> -Xylene	15
397	<i>p</i> -Xylidine	15
398	Pyrogallol	133
399	Pyrogallol triacetate	161
400	Pyruvic acid	13
401	Quinhydrone	171
402	Quinonemonoxime	126
403	Raffinose	118
404	Resorcinol	118
405	Resorcinol dibenzoate	117
406	Retene	98
407	<i>s</i> -Acetylphenylurea	183
408	Salicin	201
409	Salicylamide	139
410	Salicylic acid	155
411	Sarcosine	210
412	<i>s</i> -Benzoylphenylhydrazine	168
413	<i>s</i> -Dibenzylurea	167
414	<i>s</i> -Di- <i>o</i> -tolylurea	250
415	<i>s</i> -Di- <i>p</i> -tolylurea	268
416	Sebacic acid	133
417	Semicarbazide	96
418	β -Acetnaphthylamide	134
419	β -Benzaldoxime	128
420	β -Benzenehexachloride	310
421	β -Bromonaphthalene	59
422	β -Bromopropionic acid	62
423	β -bromostyrene	7
424	β -Chloronaphthalene	56
425	β -Chloropropionic acid	41
426	β -Iodopropionic acid	82
427	β -methylnaphthalene	32
428	β -Naphthol	122
429	β -Naphthonitrile	66
430	β -Naphthoquinone	120
431	β -Naphthyl benzoate	107
432	β -naphthyl ethyl ether	37
433	β -naphthyl methyl ether	72
434	β -Naphthyl salicylate	95
435	β -Naphthylamine	111
436	β -Napthoic acid	182

437	Stearic acid	69
438	Stilbene	125
439	s-tribromoanisole	87
440	s-tribromophenetole	72
441	s-tribromophenol	95
442	s-trichloroanisole	60
443	s-trichlorophenetole	43
444	s-trichlorophenol	67
445	Succinamide	242
446	Succinanil	156
447	Succinanilide	226
448	Succinic acid	185
449	Succinic anhydride	130
450	Succinimide	125
451	Sucrose	160
452	Terpin hydrate	116
453	Terpineol	35
454	<i>tert</i> - Buthyl alcohol	25
455	Tetrachlorophthalic acid	250
456	Tetramethyldiaminobenzophenone	174
457	Tetramethyldiaminodiphenylmethane	90
458	Theobromine	290
459	Theophylline	270
460	Theophylline	264
461	Thiodiglycollic acid	129
462	Thymol	50
463	Thymoquinone	45
464	Thymyl benzoate	33
465	Toluhydroquinon	124
466	Toluquinone	68
467	Toluquinone	68
468	Tribenzylamine	91
469	Tribromorophenol	95
470	Trichloroacetic acid	55
471	Trichlorolactic acid	124
472	Trichlorophenol	67
473	Triphenylamine	127
474	Triphenylcarbinol	162
475	Triphenyldicarbimide	74
476	Triphenylguanidine	145
477	Triphenylmethane	92
478	Urea	132
479	Vanillic acid	207
480	Vanillin	80
481	Venilic acid	207
482	Veratrole	15
483	Xanthenylurea	225
484	Zalcitabine	215
485	Zidovudine	123
486	α - gamma-Dichloroacetone	45

487	α,β -Dibromopropionic acid	64
488	α -Acetaldoxime	47
489	α -Acetnaphthylamide	159
490	α -Aminoisobutylic acid	280
491	α -Benzaldoxime	33
492	α -Benzenehexachloride	157
493	α -Benzildioxime	237
494	α -Bromocamphor	76
495	α -Bromonaphthalene	4
496	α -Bromopropionic acid	24
497	α -crotonic	72
498	α -methylglucoside	165
499	α -Naphthol	94
500	α -Naphthonitrile	33
501	α -Naphthoquinone	125
502	α -naphthylamine	50
503	α -Naphtholic acid	160

Where, °C- Degree Celsius, *p*-para, *m*-meta, *o*-ortho, *l*-levo, *d*-dextro, α -alpha, β -beta, γ -gamma, *tert*-tertiary, *s*-salt

Conclusion:

This review highlights the critical importance of melting point which is a fundamental property that plays an important role in drug development and quality control. Melting point analysis not only serves as an essential tool for verifying compound purity and identity but also provides valuable insights into the thermal stability and crystallinity of pharmaceutical substances. The data gathered demonstrates how variations in melting points can reflect structural differences and influence the physical properties that affect drug formulation, bioavailability, and shelf life. Melting points in pharmaceutical science provides a foundational resource for researchers, developers in drug design, and manufacturers.

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